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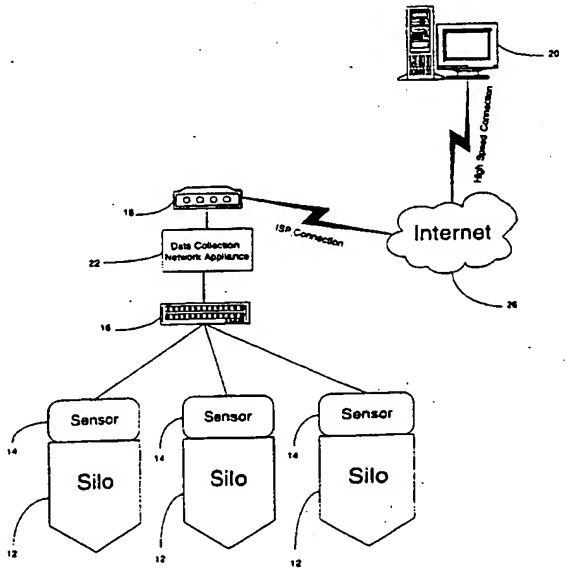
(54) Title: DATA COLLECTION NETWORK APPLIANCE AND METHOD



(57) Abstract: A data collection network appliance (22) and method. The data collection network appliance (22) and method receives data obtained from a sensor controller (16) and securely pushes the data over a public network (26) such as the Internet to a server located at a remote central data processing center (20) using standard Internet protocols. The data collection network appliance (22) is suitable for use in an inventory management system.

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DATA COLLECTION NETWORK APPLIANCE AND METHOD

BACKGROUND OF THE INVENTION

This invention relates generally to an inventory management system and more particularly to a network appliance that automates the process of gathering data from an industrial machine and securely pushing the data over a public network to a central data processing center using standard Internet protocols.

In one type of inventory management system there are storage containers such as silos for storing material. A sensor, connected to each of the silos in the inventory management system, measures the amount of material in the silo. A sensor controller connected to each of the sensors receives the measurement data. The sensor controller transmits the measurement data to a purchasing agent located at a remote site. The purchasing agent evaluates the measurement data and determines if the silos need more material. If there is a need for more material, the purchasing agent contacts a vendor to determine if the vendor has an inventory of material available. If there is inventory available from the vendor, then the purchasing agent places an order. The vendor fills the order and transports the material to the silos by suitable transportation such as a truck or a train.

A problem with this type of inventory management system is that the transmission of the measurement data from the sensor controller to the purchasing agent located at the remote site can be quite expensive. Typically, the sensor controller transmits the measurement data to a server located at the purchasing agent's site through a modem connection after the agent has made a request. This is referred to as "pulling" the data because the server makes a request for the data to the sensor controller. In most cases, the purchasing agent is a long distance call away from the site of the inventory management system where the silos, sensors and sensor controller are. In addition, the server pulls the measurement data from the sensor controller sometimes every two hours to ensure that there is enough material. However, that may vary according to the consumption rate of material. The combination of the sensor controller transmitting the measurement data to the purchasing agent's server via a long distance

call and that the transmission occurs fairly frequently, results in an inventory management system that is expensive to maintain. In some cases, the costs to transmit measurement data from the sensor controller to the purchasing agent's server can be as high as a thousand dollars a month. Other problems may exist in large inventory management systems that have many sensors. In particular, many of the current inventory management systems are not scaleable to handle the data collection and transmission functions performed by all of the sensors.

In order to overcome the above problems, there is a need for a device that can enable the inventory management system to transmit the measurement data from the sensor controller to the purchasing agent's server in a low-cost and secure manner.

BRIEF SUMMARY OF THE INVENTION

In accordance with one embodiment of this invention, there is a data collection network appliance. The data collection network appliance comprises a scheduler for coordinating data collection events. A data collector gathers data according to a schedule set by the scheduler. A data transmitter transmits the collected data over a network according to the schedule.

Similarly, in this invention there is a method for collecting data and transmitting over a network. The method comprises coordinating data collection events; collecting data according to the coordinating of events; and transmitting the collected data over a network according to the coordinating of events.

Also, in this invention there is a computer-readable medium storing computer instructions for instructing a computer to collect data and transmit the data over a network. The computer instructions comprise coordinating data collection events; collecting data according to the coordinating events; and transmitting the collected data over a network according to the coordinating of events.

In another embodiment of this invention there is a system for collecting data and transmitting over a network. In this system there is a plurality of sensors for measuring data. A data collection network appliance is coupled to the plurality of sensors. The data collection network appliance comprises a scheduler for coordinating data collection events, a data collector for gathering data from the plurality of sensors according to a schedule set by the scheduler, and a data transmitter

for transmitting the collected data according to the schedule. In this system there is also a data processing center for communicating with the data collection network appliance. A network couples the data collection network appliance and the data processing center.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a schematic diagram of an inventory management system according to the prior art;

Fig. 2 shows a schematic diagram of a data collection network appliance used in an inventory management system according to this invention;

Fig. 3 shows a schematic of the software architecture of the data collection network appliance according to this invention;

Fig. 4 shows a flow chart describing the steps of using the data collection network appliance in conjunction with an inventory management system according to this invention;

Fig. 5 shows a schematic diagram of a plurality of inventory management systems connected to a central data processing center according to this invention; and

Fig. 6 shows a schematic of the software architecture of the central data processing center used in accordance with Fig. 5.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 shows a schematic diagram of an inventory management system 10 according to the prior art. The inventory management system 10 monitors and determines real-time inventory status of one or more storage containers such as silos at a manufacturing site. Other functions performed by the inventory management system 10 may include automatic ordering of inventory to replenish the silos, evaluating inventory usage and predicting estimated future inventory usage. The inventory management system 10 comprises at least one silo 12 for storing material. Besides a silo, the inventory management system could use other storage containers such as a storage bin, hopper and bag to store the material. Although not shown in Fig. 1, a material processor such as an extruder, an injection molder, a die cast device or any other device that can use the material from the silos to produce a product can be used.

Typically, an inventory supply line such as a pneumatic line, a screw conveyor, a belt conveyor, a bucket conveyor, or a vibratory line can deliver the inventory material from each silo to the material processor so that it can be processed and formed into the product.

Also attached to each silo 12 is a sensor 14 for providing signals indicative of the amount of inventory in the silo. The sensor 14 may be any type of amount indicator that permits the determination of the amount of material in a storage container. In particular, the sensor may include devices such as a level sensor, a weight indicator, a volume analyzer, an ultrasonic level detector, an optical sensor or a laser-sensing detector. A sensor controller 16 connected to the sensors 14 receives the signals indicative of the inventory amount in each silo 12. The sensor controller may also receive signals from other on-site storage containers located at the manufacturing site. Although not shown in Fig. 1, the other on-site storage containers may include a warehouse and on-site transport vehicles such as a rail car, a vessel or a truck, that have delivered inventory to the manufacturing site.

A modem 18 will transmit the inventory amount signals from the sensor controller 16 to a server 20 remotely located from the manufacturing site after the server has actually dialed out to the modem. Generally, the server 20 periodically dials out to the modem 18 to forward the inventory amount signals to the server. The server 20 determines the amount of inventory used, estimates future use of the material and determines if more material needs to be ordered. Although not shown in Fig. 1, there are several other sources that the server 20 relies on to perform its intended functions. For example, an inventory price source provides pricing information (e.g., economic indicators, economic models, pricing indexes, etc.) that enables the server 20 to determine the lowest available price for the inventory of material. In addition, a shipping information source provides the server 20 with information (e.g., tariffs, taxes, forms of shipping, availability of shipping, etc.) for analyzing the availability of inventory and the types and costs of transporting the inventory from a vendor to the manufacturing site. Another source connected to the server 20 is a transportation advisory unit that provides advisory information concerning road conditions, rail conditions, water conditions, existing and possible delays, construction along possible transportation routes, weather information that may affect the shipment. A more

detailed description of this type of inventory management system is provided in commonly-assigned U.S. patent application serial number 09/191,910, entitled "Inventory Management System and Method", which is incorporated herein by reference.

Fig. 2 is a schematic diagram of a data collection network appliance 22 in use with an inventory management system 24 according to this invention. The data collection network appliance 22 automates the process of gathering data from the sensor controller 16 and securely pushes the data over a network 26 such as the Internet via a network connection device such as a modem 18 and an Internet Service Provider (ISP) connection. This invention is not limited to the use of the modem, and in particular, other network connection devices can be used like an integrated services digital network (ISDN), local-area-network (LAN), Ethernet, 10Base-T, 100Base-T, etc. that uses protocols such as an TCP/IP, AppleTalk, etc. The server 20 located at a remote central data processing center receives the transmitted data from the network 26 using a high-speed connection device such as a T1 line. The data collection network appliance 22 enables the inventory management system 24 of this invention to overcome the high costs associated with the inventory management system 10 of the prior art. In particular, in the inventory management system 24 of this embodiment, the data collection network appliance 22 transmits the data from the manufacturing site to the network 26 by an ISP connection that is made through a local telephone call. On the other hand, the inventory management system 10 of the prior art transmits the data from the manufacturing site to the server 20 through a modem connection that typically comprises long distance telephone calls. Since the ISP connection is made through a local telephone call and not a long distance telephone call, the costs to transmit data from the manufacturing site to the central data processing center will be significantly less. Other network connection devices would also provide a significant cost reduction as compared to the prior art.

The data collection network appliance 22 is a computer such as a workstation or a personal computer containing a processor, memory including random access memory (RAM), read only memory (ROM) and may include other components such as a keyboard, a mouse device and a monitor as a convenience for human interaction. The data collection network appliance 22 operates under control of an operating system

stored in the memory to present data on the display of the monitor and to accept and process commands via the keyboard and the mouse device. Although the data collection network appliance 22 is described with reference to a workstation or personal computer, it is possible to use other computer devices with this invention that include but are not limited to a mini-computer, a micro-computer, a mainframe computer and a personal digital assistant. The data collection network appliance 22 contains one or more computer programs for implementing this invention. A computer-readable medium such as a fixed data storage device tangibly embody the computer programs of the data collection network appliance 22 and its operating system. The computer programs are programmed in Java, but other languages such as C, C++, Basic, etc. may be used.

Fig. 3 shows a schematic of the software architecture 28 of the data collection network appliance 22 according to this invention. At the core of the data collection network appliance's architecture is the operating system. The operating system provides a software platform on top of which other programs can run. For personal computers, the operating system may be DOS, OS/2, Windows, PALM/OS and JavaOS, whereas for a workstation, a multi-user, multi-tasking operating system such as UNIX is typically used. On top of the operating system is a Java virtual machine, which is a self-contained operating environment that behaves as if it is a separate computer. Typically, the Java virtual machine runs small Java programs that have been compiled into byte code, which can be run on the Java Virtual Machine.

Residing on top of the Java virtual machine are Java classes which are software modules or objects that encapsulate data and behavior. Optionally, other applications such as Jini software provided by Sun Microsystems can reside on the Java virtual machine. The Jini software simplifies the connection and sharing of devices, such as printers and disk drives on a network. In particular, the Jini software announces itself to the network, provides some details about its capabilities, and immediately becomes accessible to other devices on the network. This allows users to access the power and features of any device on the network and frees the desktop computer from holding all the memory, storage and processing power it needs for any job. In addition to the Java virtual machine, device driver applications reside on the operating system. The

device driver applications are programs that control devices such as the keyboard, printer, modem, serial ports, etc.

On top of the device drivers, Jini and the Java classes are four software modules that enable the data collection network appliance 22 to gather data from the sensor controller 16 and securely push the data over the network 26 (Internet) to the server 20 using standard Internet protocols. One of those four software modules is a scheduling application that decides when the data collection network appliance 22 should be sleeping and when it should be woken up. Generally, when the data collection network appliance 22 wakes up it can instruct the sensor controller 16 to poll the sensors 14 or it can submit measured data from the controller to the server 20 over the network 26. Both polling the sensors and submitting measured data are functions of other software modules (i.e., data collection and data transmission). The data collection application is responsible for connecting the data collection network appliance 22 to the sensor controller 16 using the appropriate device drivers such as a RS232 device. Once the sensor controller 16 is connected to the sensors 14, data is gathered and cached. The data transmission application is responsible for dialing the modem 18 to make an ISP connection using point-to-point protocol (PPP). In addition, the data transmission application establishes a secure socket layer (SSL) connection with a Web server application running on the server 20. A SSL is a protocol for transmitting private documents via the Internet. Typically, a private key is used to encrypt data that is transferred over the SSL connection. By convention, Web pages that require an SSL connection start with https, instead of http (hyper text transfer protocol). Another protocol that can be used for transmitting data securely over the World Wide Web (i.e., a system of Internet servers that support documents formatted in a language called hypertext markup language or html) is secure http (s-http). Whereas a SSL creates a secure connection between a client and a server, over which any amount of data can be sent securely, s-http is designed to transmit individual messages securely.

Another software module that is used by the data collection network appliance 22 is the code maintenance application. The code maintenance application allows an administrator to remotely update code in the data collection network appliance 22 from the central data processing center. In addition, the code maintenance application

allows any one of the other applications (i.e., scheduling, data transmission or data collection) to check if it is running the most recent software version. If not, the application can download the most recent version from the server 20 located at the central data processing center using the code maintenance application and installs it.

Fig. 4 shows a flow chart describing the steps of using the data collection network appliance 22 in conjunction with an inventory management system. First, at block 30, a field engineer goes to the manufacturing site and installs the hardware and software necessary to implement the data collection network appliance. In particular, the field engineer sets the initial configuration parameters for the data collection network appliance. Possible examples of configuration parameters that are set include determining how often to poll the sensors 14, how often to submit data to the server 20, error recovery parameters, and local ISP configuration data. At block 32, an administrator located at the central data processing center creates a record for the data collection network appliance at that particular site. The record may include a unique identifier for the data collection network appliance as well as any other identifiers used with the silos, sensors and sensor controller. If desired, the administrator can add or remove silos from the record. In addition, the administrator sets up a customer user account at 34 so that the user can monitor the level of material in the silo as well as perform any other functions (e.g., silo trending) provided by the inventory management system.

After performing the initial set up, the data collection network appliance 22 is ready for operation. At 36, the data collection application requests that the sensor controller instruct the sensors to measure the level of material in the silos. Next, the data transmission application securely pushes the measured data over the network to the server using the modem and ISP connection at 38. As mentioned above, the data transmission application securely pushes the measured data on a periodic basis using a SSL connection. Typically, the data is pushed to the server every two hours; however, this invention is not limited to this time period and can be performed as more or little as the user or administrator would like. If it is determined that a software update is needed at 40, then the code maintenance application downloads the latest version at 42 and the data collection and transmission steps are repeated. After receiving the measured data, the data processing center uses the data to perform the above described

inventory management system functions at 44 which are also set forth in commonly-assigned U.S. patent application serial number 09/191,910, entitled "Inventory Management System and Method". Steps 36-44 are continuously repeated to provide a system that is up and running 24 hours a day, seven days a week with the exception for scheduled downtimes for maintenance.

Fig. 5 shows a schematic diagram of a plurality of inventory management systems connected to a central data processing center according to this invention. In Fig. 5 there are only two inventory management systems connected to the server 20 of the central data processing center, however, there may be many other systems connected to the server. One of the inventory management systems shown in Fig. 5 is identical to the one shown in Fig. 2. In particular, this system comprises a plurality of silos 12, sensors 14 coupled to the silos, a sensor controller 16, a data collection network appliance 22 and a modem 18. An ISP connection connects this system to the server 20 through a network 26 such as the Internet. The other inventory management system shown in Fig. 5 comprises one silo 12, a sensor 14, a sensor controller 16, a data collection network appliance 22 and a satellite dish 46. In this system, a satellite 48 receives measurement signals from the satellite dish 46. An ISP 50 receives the signals from the satellite 48 through another satellite dish 52 and sends them to the server 20 located at the central data processing center over the network 26. As mentioned above, the server 20 can be connected to the network 26 over a high-speed connection such as a T1 line and the ISP can be connected to the network by a high-speed connection such as a T3 line. The schematic of Fig. 5 is illustrative of only a couple of combinations of possible inventory management systems that could be implemented and is not intended to limit this invention thereto.

Fig. 6 shows a schematic of the software architecture 54 of the central data processing center used in accordance with Fig. 5. At the core of this architecture is the operating system. The operating system may be DOS, OS/2 and Windows for a personal computer and UNIX for a workstation. On top of the operating system is a Java virtual machine, which runs the optional Jini software and Java classes. In addition to the Java virtual machine, http server application(s), a virtual control application and database service application reside on the operating system. The http server application provides access control, administration and viewing functions. The virtual

control application performs forecasting functions, trending functions, alarming functions, etc. and may be an application such as CIMPLICITY or Bridge View. The database services application keeps track of silo information, site information, company information, etc.

On top of the above-described applications resides a client web application, an appliance data collection application and an appliance code maintenance application. The appliance data collection application allows the server to collect the measured data obtained from the sensors at the remote-manufacturing site. The appliance code maintenance application allows the server to provide an updated version of software to the data collection network appliance 22.

It is apparent that there has been provided in accordance with this invention, a data collection network appliance and method. While the invention has been particularly shown and described in conjunction with a preferred embodiment thereof, it will be appreciated that variations and modifications can be effected by a person of ordinary skill in the art without departing from the scope of the invention.

WHAT IS CLAIMED IS:

1. A data collection network appliance (22), comprising:

a scheduler for coordinating data collection events;

a data collector for gathering data according to a schedule set by the scheduler; and

a data transmitter for transmitting the collected data over a network (26) according to the schedule.

2. The appliance (22) according to claim 1, further comprising a code maintenance provider for downloading code updates from the network (26).

3. The appliance (22) according to claim 1, wherein the data transmitter comprises a data pusher for pushing the collected data over the network (26) at predetermined time intervals.

4. The appliance (22) according to claim 1, wherein the data transmitter uses a standard Internet protocol to transmit the collected data over the network (26).

5. The appliance (22) according to claim 4, wherein the standard Internet protocol comprises a protocol for securely transmitting data over the network (26).

6. A data collection network appliance (22), comprising:

means for scheduling data collection events;

means for collecting data according to the scheduling means; and

means for transmitting the collected data over a network (26) according to the scheduling means.

7. The appliance (22) according to claim 6, further comprising means for downloading code updates from the network (26).

8. The appliance (22) according to claim 6, wherein the transmitting means comprises means for pushing the collected data over the network (26) at predetermined time intervals.

9. The appliance (22) according to claim 6, wherein the transmitting means uses a standard Internet protocol to transmit the collected data over the network (26).

10. The appliance (22) according to claim 9, wherein the standard Internet protocol comprises a protocol for securely transmitting data over the network (26).

11. A method for collecting data and transmitting over a network (26), comprising the steps of:

coordinating data collection events;

collecting data according to the coordinating of events; and

transmitting the collected data over a network (26) according to the coordinating of events.

12. The method according to claim 11, further comprising downloading code updates from the network (26).

13. The method according to claim 11, wherein the transmitting comprises pushing the collected data over the network (26) at predetermined time intervals.

14. The method according to claim 11, wherein the transmitting uses a standard Internet protocol to transmit the collected data over the network (26).

15. The method according to claim 14, wherein the standard Internet protocol comprises a protocol for securely transmitting data over the network (26).

16. A computer-readable medium storing computer instructions for

instructing a computer to collect data and transmit the data over a network (26), the computer instructions comprising:

coordinating data collection events;

collecting data according to the coordinating of events; and

transmitting the collected data over a network (26) according to the coordinating of events.

17. The computer-readable medium according to claim 16, further comprising computer instructions for downloading code updates from the network (26).

18. The computer-readable medium according to claim 16, wherein the transmitting instructions comprise pushing the collected data over the network (26) at predetermined time intervals.

19. The computer-readable medium according to claim 16, wherein the transmitting instructions uses a standard Internet protocol to transmit the collected data over the network (26).

20. The computer-readable medium according to claim 19, wherein the standard Internet protocol comprises a protocol for securely transmitting data over the network (26).

21. A system (24) for collecting data and transmitting the data over a network (26), comprising:

a plurality of sensors (14) for measuring data;

a data collection network appliance (22) coupled to said plurality of sensors (14), said data collection network appliance (22) comprising a scheduler for coordinating data collection events, a data collector for gathering data from said plurality of sensors (14) according to a schedule set by said scheduler, and a data transmitter for transmitting the collected data according to the schedule;

a data processing center (20) for communicating with said data collection network appliance (22); and

a network (26) coupling said data collection network appliance (22) and said data processing center (20).

22. The system (24) according to claim 21, further comprising a sensor controller (16) for controlling said plurality of sensors (14) and providing the measured data to said data collection network appliance (22).

23. The system (24) according to claim 21, further comprising a network connection device (18) for transmitting and receiving data and files over said network (26).

24. The system (24) according to claim 23, further comprising an Internet Service Provider connection between said network connection device (18) and said network (26).

25. The system (24) according to claim 21, wherein said data collection network appliance (22) further comprises a code maintenance provider for downloading code updates sent from said data processing center (20) over said network (26).

26. The system (24) according to claim 21, wherein said data collection network appliance (22) further comprises a data pusher for pushing the collected data over said network (26) at predetermined time intervals.

27. The system (24) according to claim 21, wherein said data collection network appliance (22) uses a standard Internet protocol to transmit the collected data over said network (26).

28. The system (24) according to claim 27, wherein the standard Internet protocol comprises a protocol for securely transmitting data over said network (26).

29. The system (24) according to claim 21, further comprising an Internet Service Provider connection between said data processing center (20) and said network (26).

30. The system (24) according to claim 21, further comprising a T1 line connection between said data processing center (20) and said network (26).

31. The system (24) according to claim 21, further comprising a satellite (48) for connecting said data collection network appliance (22) and said network (26).

32. The system according to claim 31, further comprising an Internet Service Provider connection between said satellite (48) and said network (26).

33. An inventory management system, comprising:

at least one storage receptacle (12) that stores inventory;

at least one indicator (14) that determines an inventory amount in each storage receptacle (12), each indicator (14) generating inventory amount signals representative of the inventory amount in the receptacle (12);

a data collection network appliance (22) coupled to each indicator (14), the data collection network appliance (22) comprising a scheduler for coordinating data collection events, a data collector for gathering data from each indicator (14) according to a schedule set by the scheduler, and a data transmitter for transmitting the collected data according to the schedule;

a data processing center (20) for communicating with the data collection network appliance (22), wherein the data processing center (20) analyzes the transmitted data to determine inventory amounts in each receptacle (12) and analyzes the inventory amounts to determine if an inventory order should be placed; and

a network(26) coupling the data collection network appliance (22) and the data processing center (20).

34. The system according to claim 33, further comprising an indicator controller (16) for controlling each indicator (14) and providing the data to the data collection network appliance (22).

35. The system according to claim 33, further comprising a network connection device (18 or 46) coupled to the data collection network appliance (22) for transmitting and receiving data and files over the network (26).

36. The system according to claim 35, further comprising an Internet Service Provider connection between the network connection device (18 or 46) and the network (26).

37. The system according to claim 33, wherein the data collection network appliance (22) further comprises a code maintenance provider for downloading code updates sent from the data processing center (20) over the network (26).

38. The system according to claim 33, wherein the data collection network appliance (22) further comprises a data pusher for pushing the collected data over the network (26) at predetermined time intervals.

39. The system according to claim 33, wherein the data collection network appliance (22) uses a standard Internet protocol to transmit the collected data over the network (26).

40. The system according to claim 39, wherein the standard Internet protocol comprises a protocol for securely transmitting data over the network (26).

41. The system according to claim 33, further comprising an Internet service provider connection between the data processing center (20) and the network (26).

42. The system according to claim 33, further comprising a T1 line connection between the data processing center (20) and the network (26).

43. The system according to claim 33, further comprising a satellite (48) for connecting the data collection network appliance (22) and the network (26).

44. The system according to claim 43, further comprising an Internet Service Provider connection between the satellite (26) and the network (26).

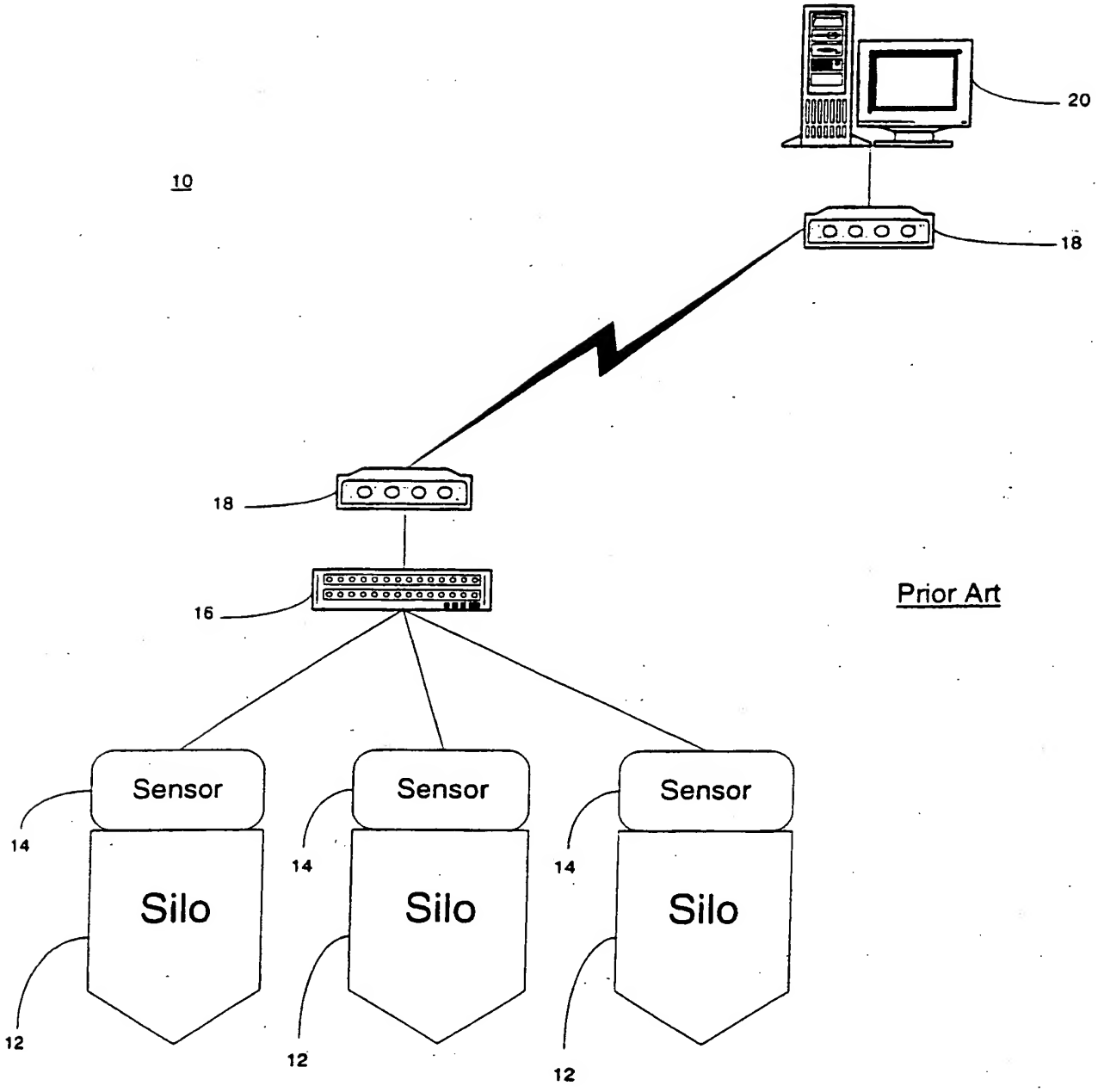
10
20
18
18
16
Sensor
Sensor
Sensor
14
14
14
Silo
Silo
Silo
12
12
12
Prior Art

FIG. 1

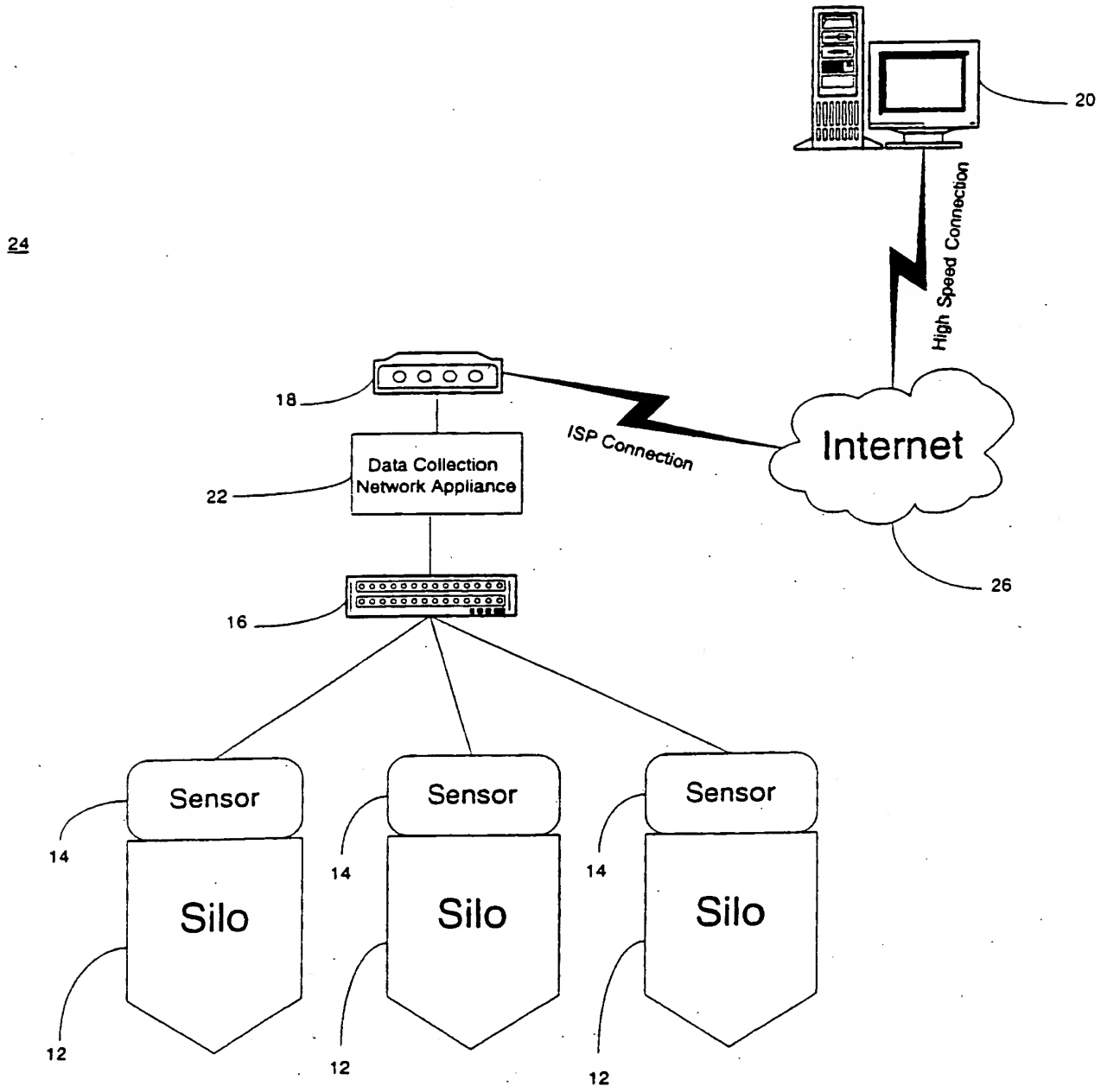
24
20
High Speed Connection
18
ISP Connection
Internet
Data Collection
Network Appliance
22
26
16
Sensor
Sensor
Sensor
14
14
14
Silo
Silo
Silo
12
12
12

FIG. 2

28

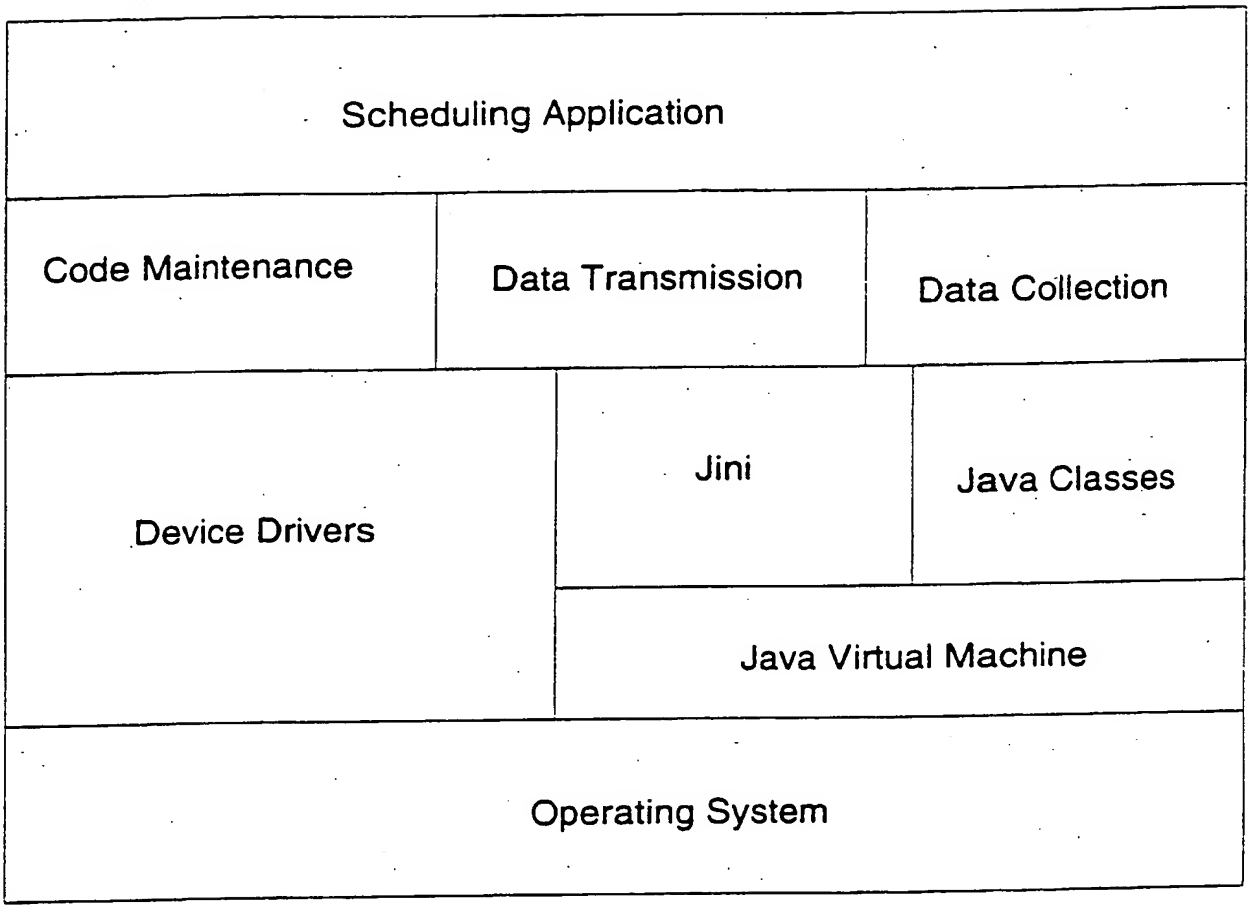
Scheduling Application
Code Maintenance
Data Transmission
Data Collection
Device Drivers
Jini
Java Classes
Java Virtual Machine
Operating System

FIG. 3

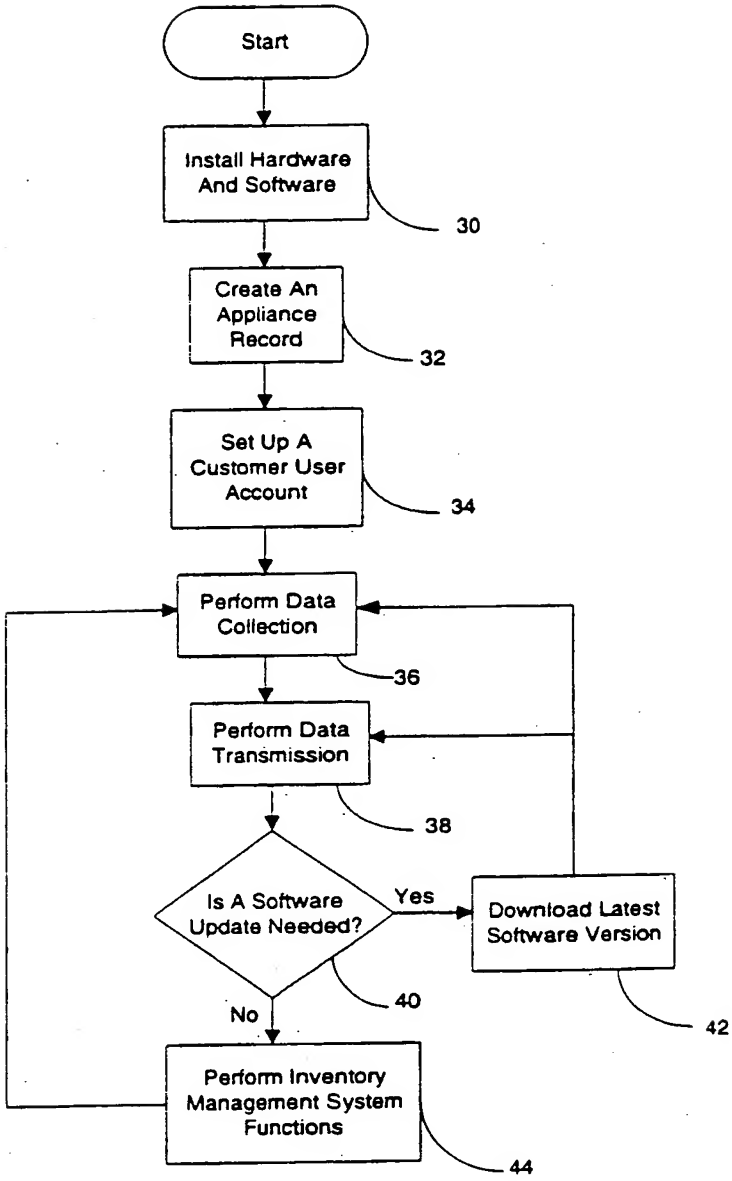
Start
Install Hardware And Software
30
Create An Appliance Record
32
Set Up A Customer User Account
34
Perform Data Collection
36
Perform Data Transmission
38
Is A Software Update Needed?
Yes
Download Latest Software Version
40
42
No
Perform Inventory Management System Functions
44

FIG. 4

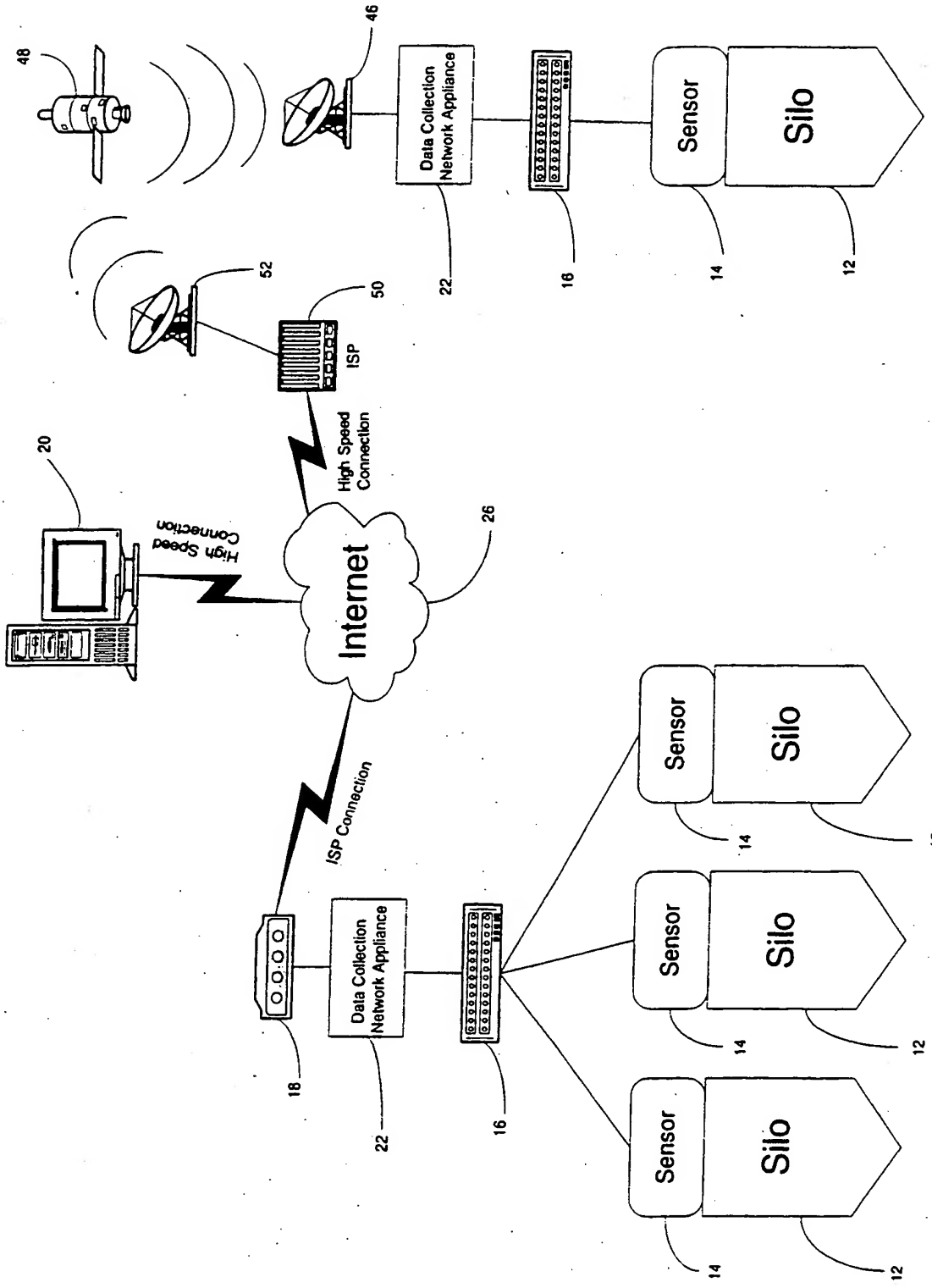
Sensor
Silo
Data Collection Network Appliance
Internet
ISP
High Speed Connection
ISP Connection
High Speed Connection
12
14
16
18
20
22
26
46
48
50
52

FIG. 5

54

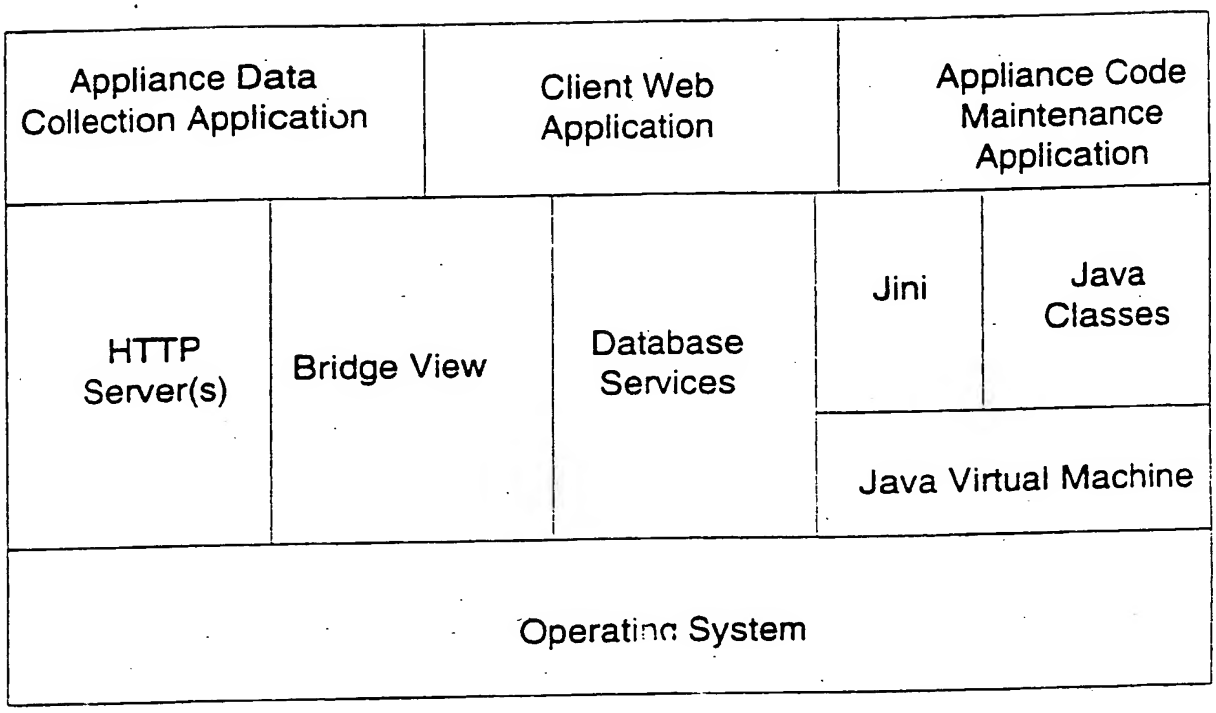
Appliance Data Collection Application
Client Web Application
Appliance Code Maintenance Application
HTTP Server(s)
Bridge View
Database Services
Jini
Java Classes
Java Virtual Machine
Operating System

FIG. 6

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(72) Inventors: DEITSCH, Andrew, Isaac; 62 Longwood Drive, Clifton Park, NY 12065 (US). CERRONE, David, Francis; 1832 Broadway, Schenectady, NY 12306 (US).

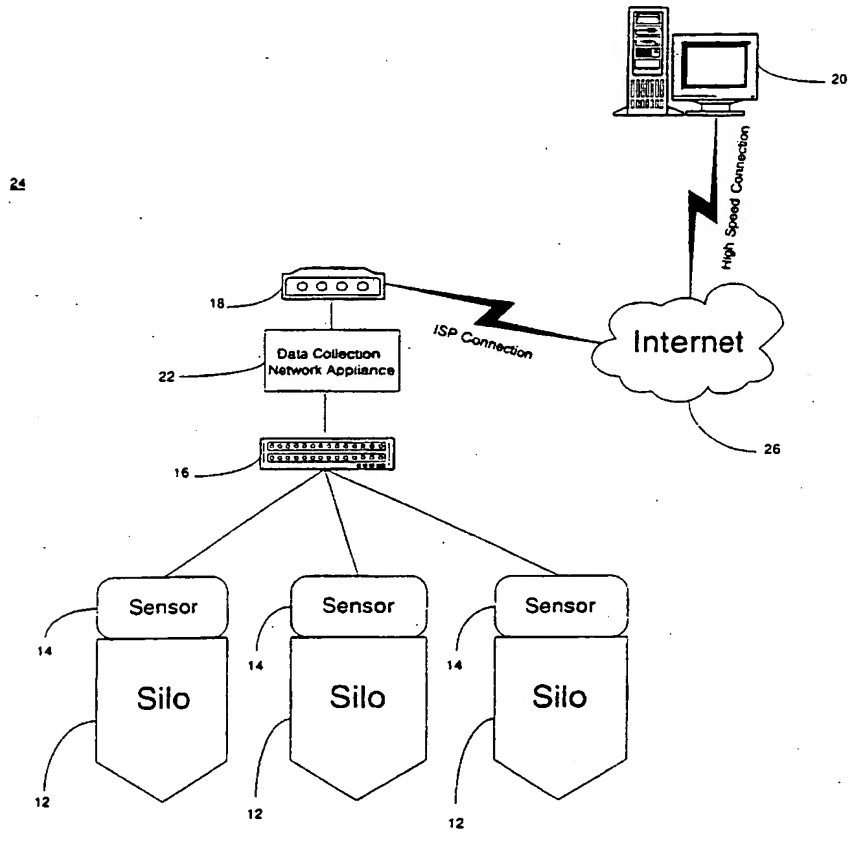
(74) Agents: SNYDER, Bernard et al.; General Electric Company, 3135 Easton Turnpike W3C, Fairfield, CT 06431 (US).

(81) Designated States *(national)*: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: DATA COLLECTION NETWORK APPLIANCE AND METHOD



(57) Abstract: A data collection network appliance (22) and method. The data collection network appliance (22) and method receives data obtained from a sensor controller (16) and securely pushes the data over a public network (26) such as the Internet to a server located at a remote central data processing center (20) using standard Internet protocols. The data collection network appliance (22) is suitable for use in an inventory management system.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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Inte. onal Application No
PCT/US 00/27913

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04M11/00 H04L12/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04L H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 99 46921 A (NOKIA MOBILE PHONES LTD ;OKKONEN HARRI (FI); HEINONEN PEKKA (FI)) 16 September 1999 (1999-09-16)	1,3,4,6, 8,9,11, 13,14, 16,18, 19, 21-24, 26,27,29
Y	abstract	2,5,7, 10,12, 15,17, 20,25, 28,30-44
	page 2, line 5 - line 7 page 4, line 4 - line 9 page 4, line 29 -page 5, line 17 page 7, line 25 - line 29 figures 1,4	
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
10 September 2001	17/09/2001

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/US 00/27913

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	WO 99 50801 A (HAMM DOUG A) 7 October 1999 (1999-10-07)	30-44
A	abstract page 2, line 13 - line 20 page 4, line 14 -page 5, line 8 page 5, line 29 -page 6, line 13 page 26, line 24 -page 27, line 2	1,6,11, 16
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A	abstract page 2, line 33 -page 3, line 11 page 4, line 27 - line 32 page 6, line 24 -page 7, line 5 page 7, line 25 - line 31 page 8, line 16 - line 20 page 8, line 28 -page 9, line 2	33
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INTERNATIONAL SEARCH REPORT

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